

THE COMET SISTERS – Teacher version

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This is a story about comets. Some of what I tell you is true about comets. Some of what I tell you, we think might be true and some of it – is just made up. See if you can tell which is which.

Long, long ago, the people of Earth had a close personal relationship with the planets and bodies in space. But none was sweeter than the relationship between the villagers of the earth and the Comet Sisters. Now, the Comet Sisters lived in the *cold, dark, outer regions of space and each one had a chosen time to make her journey toward the Earth and Sun*. The villagers looked forward to this time because there was always a great celebration. Every family in the village would cook their best food, and prepare their most special music, and put on their nicest clothes. And there was great excitement.

When it was time for the Comet Sister who had been chosen to begin her journey, she *made her way from the cold, dark outer regions of space toward the Earth and the Sun*. The villagers gathered their food and their instruments and make their way to the meadow where the celebration always took place. Most important, each family took with them a very large basket. As the families from the village approached the field, they looked into the sky and stopped – dead - still. *For as the Comet Sister approached, and her cold body was warmed by the Sun, her face began to heat and glow, and her hair began to reflect the Sun's light and grow in long streaming strands behind her. And her robes and cape began to shimmer and grow behind her in a long bright tail millions of miles long*. And the villagers had to admit; that it was the most beautiful sight they had ever seen.

Now the Comet Sister landed in the meadow and they all greeted each other warmly, and began their celebration. Everyone sang and ate till they were filled, and danced to music throughout the night as their friendship was renewed. But the most wonderful part of the evening was close to the end, when the Comet Sister gathered all the villagers, young and old, and they sat at her feet. And as they sat there, she *told them secret stories from the beginning of time. For the Comet Sisters still knew stories from long ago when the world was a whirling pool and the planets were still forming in space*. The villagers sat breathless listening to these stories trying to imagine how that time must have been. It was this way until morning. When the first dawn light was about to appear, the Comet Sister gathered the villagers and each family brought their basket. She took long strands from her hair, gifts of reflected light from the Sun *and pieces of her robe with water for their fields and parts of her cape with life for their harvests*. She threw these gifts into the baskets. When each family's basket was full, they wished each other farewell and the Comet Sister rose into the sky, *made her way to visit the Sun and then returned back to her sisters* to let them know that all was well with their village friends.

The villagers returned to their homes with their gifts and cherished them and used them wisely over time. It was this way for generations, and it was a relationship of light and love and great loyalty.

Now it came to pass, that the newer generations did not have the same love in their hearts for the Comet Sisters and not, as it turned out, the same loyalty. They began to complain each time a Comet Sister would come and felt it wasn't important to go to the meadows to celebrate and renew their relationship. Eventually, they were bored and wanted something new and more exciting to treasure. Some of them went out into the world and hunted and one day, one of them returned. "Look" he said, "I have found something new called *fire*." The people gathered around fire and took it into their homes and formed a relationship with it for what it could give, and what they did not have to give in return. And it was a relationship of light and love.

The Comet Sisters were saddened that the villagers no longer came to the meadow or kept their relationship and so *they did not land on the Earth*. Instead, *they floated through space* glancing down to watch their friends. The comets were still a beautiful sight, but the villagers often ignored them. So it was, that each chosen sister *passed by the Earth, greeted the Sun as before, and then returned to the cold outer regions* to report the sad news to her family.

At last, the villagers forgot the Comet Sisters altogether and the secret stories of the beginning of the world faded from their memories. It was this way for many years until the newer generations became even colder in their hearts. As they had become bored with the Comet Sisters, so they became bored with their friend, fire. Some of the villagers went out into the world to look for new excitement and one day, one of them returned and said, "Look – we have found *Electricity*. We can use electricity and we don't need to form a relationship with it. It is ours to use." And so, rather than form a relationship with electricity, they enslaved it and used it for what it could give them. And it was a relationship of light.

Well, what is not nurtured and loved, eventually dies. And so it was that electricity finally died and the villagers were left in great darkness both in their homes - and in their hearts. Being cunning by nature, they gathered together to discuss their plight and one of them reminded the others of the relationship their relatives had once had with the Comet Sisters, and of the gifts they brought. "We should ask them to come again and bring us their gifts," said one. But the others complained that it was too much work to go to the meadows, or make the food and plan the celebration. Finally, one of them had a plan. "If we invite one of the Comet Sisters to come to Earth, we won't have to form a relationship. We can just capture her and cut off all her hair and take her robe and cape and we will have plenty of light and water and life to last for our lives." All the villagers thought it was a fine idea and so they called the Comet Sisters and begged them to return, and promised them their friendship.

Now, the Comet Sisters loved the villagers – but they were not stupid! "This foolish generation has no love or loyalty in their hearts. We will visit them but we will teach them a lesson." So, a date was set for the coming celebration and both the villagers and the Comet Sisters carefully planned what they must do. The villagers threw together

some food, someone knew how to play an instrument and no one even bothered to dress up. But, they did remember that each family was to bring a large basket for the gifts.

When the day arrived, the villagers started out to the meadow, each family carrying a large basket. One of the Comet Sisters was chosen to visit the village and so she departed *from the cold dark outer regions of space*. As the villagers arrived in the meadow, they looked up into the sky and stopped – dead - still. For as the Comet Sister approached them, *the Sun warmed her face and it glowed with a great light. And her long hair reflected the Sun and grew, as did her robe and her cape. And they trailed in a long stream behind her for millions of miles*. The villagers stood and starred; for they had to admit that it was the most beautiful sight they had ever seen. And suddenly, they felt something inside them - something lost long ago – an excitement and loneliness for this beautiful comet. And they ran toward her to greet her. *She grew closer, but she did not land in the meadow. Instead, she flew through the sky and as she did, she took strands from her hair and from her robe and cape and flung them toward the Earth*. In great excitement, the villagers ran toward the shining strands *but as each one came closer to the earth, its light burned out and disappeared before they could catch it*. She threw another, and another, and they ran to each one, but its light would die before they could get to it.

And so it was throughout the night. The Comet Sister threw a shining strand toward the earth and the villagers would run toward it *only to have it vanish from its trail*. The villagers ran back and forth throughout the meadow until dawn and could not catch one single strand of the comet's hair or robe or cape. And finally, as the first light of day appeared, she continued on her journey to greet the Sun before she returned again to her sisters. The villagers could only return to their houses where they remained in darkness - both in their homes, and in their hearts.

As for the Comet Sisters, they made a difficult decision together. They would never again come to the meadows. If the villagers wanted a relationship with them, *they must come to them and search for them in space. And only then, would they renew their friendship. And only then, would the villagers find the secret stories about the beginning of time*. This is the way it is to this day. And someday, *you may go out into the night to look at a meteor shower and realize that it is really the Comet Sisters, traveling through space and tossing strands of their beautiful hair and clothing into the air – glancing down at Earth and looking once more for those who can offer them a relationship of light and love and great loyalty*.

Activity Extension:

A. Find out what they know

Grades 5 - 8

Make a class list asking the students to guess which parts of the story are:

1. What scientists believe to be true about comets
2. What scientists wonder about comets
3. What is myth made for the story

Science “fact” often changes. It may be that scientists will learn new facts that will move some of the items from one column to another over time. That is the way science has worked for centuries. Learning more facts also raises more questions

Grades K - 4

Ask your class what they remember about the story and use the background information to give them facts about comets. If you feel your class is ready to evaluate the difference between fact, theory and myth, then use or modify for grades 5 – 8 above. As another exercise, give your class drawing paper and ask them to draw what strikes them about the story in either one image or several. See what they understood and what they remembered about comets.

B. Teach them something new

Look at the background material on comets included with this story. After you determine what your students know, choose from the list of comet facts and theories in *What are the science concepts here?* (See below) and share new information with them.

C. What did they learn?

Grades K - 8

1. What questions does your class now have about comets?
2. What would they like to know?
3. You can visit the Deep Impact web site to learn more about a mission to a comet and about comets in general. <http://deepimpact.jpl.nasa.gov> or <http://deepimpact.umd.edu>
4. Comets impacting Earth may have brought natural resources, water or even some of those things necessary to form life. If so, we have been using “gifts” from comets all our lives. What is the importance of guarding the resources we have, especially as we find new ones and run out of others?
5. If comets have many of the resources we need, could we someday land on a comet and mine it to live in space?
6. What would we need to know about a comet in order to gather resources from it?

D. Now let them create.

Here are some activities for your students:

1. Ask them to choose 1 – 3 of the most interesting things they learned about comets.
2. Using their favorite information about comets, have the students:
 - a. Write their own comet story
 - b. Make a model of a comet out of materials or clay and explain its parts or visit <http://deepimpact.jpl.nasa.gov/educ/CometStick.html> and make a comet model with these instructions.
 - c. Draw a picture of what how they think a comet would look like.
 - d. Many cultures have their own star or astronomy stories. Identify the cultures represented in your classroom and ask your students to research stories, especially any about comets, and to bring them to class to read.
 - e. Use other expressions like songs, dance or other art forms to communicate their feelings or questions about comets.
 - f. Act out the story of “The Comet Sisters”
 - g. Write an adventure story about what will happen when NASA missions go visit comets in space. Encourage them to mix fact, theory and fiction and to be able to defend each within their work. We would love to see your work. Send it to Maura.Rountree-Brown@jpl.nasa.gov
 - h. Take a look at the Deep Impact education page and Discovery Zone activities and choose more things for your students to do.
<http://deepimpact.jpl.nasa.gov/educ/index.html>
<http://deepimpact.jpl.nasa.gov/disczone/index.html>

E. What are the science concepts here?

1. *Where the Comet Sisters lived.* Comets come from cold regions in the Kuiper Belt near Pluto and the Oort Cloud. Some comets have never yet left the Oort Cloud to travel into our solar system and would only do so if something perturbed them into motion.
2. *As the Comet Sisters approached the Sun, her hair, robe and cape glowed and grew into a tail behind her.* Comets have a nucleus as a body. They are made of ice, rocky debris and dust and as their orbit brings them close to the Sun, their surface warms and ice and dust erupt from the comet pushing forward and then flowing back behind the nucleus in a long tail. This *outgassed* material is called coma. Comets have three tails, the main dust tail, the ion tail and the neutral sodium tail. Most people only refer to them having the dust and ion tail.
3. *A different Sister Comet was chosen to visit the villagers.* Comets have different orbits that are either over 200 years long or under 200 years long and so they appear at different times as they come nearer to us and then make their orbit around the Sun.
4. *The glowing of their bodies as they approached the Sun.* We only see the coma around the nucleus and in the tail because of the reflection of the Sun on the dust

and ice. The surface of the nucleus is actually a mottled dark black color because of rocky debris that has baked onto its surface during outgassing.

5. *The comet's beautiful hair.* Comets get their name from the Greek word kometes, which means hair.
6. *The comet left gifts of reflected light from the Sun, water for their fields and life for their harvests.* There are different theories about comets, two of which are that they may at one time have impacted the earth to bring water (water for their fields) or perhaps the early organisms for life (life for their harvests). The light simply refers to the reflection of the light of the Sun off their dusty tail and this wouldn't actually have been a gift the comet could bring or the villagers could use.
7. *The Sister Comet approached the Sun, greeted it and then continued her orbit back to the cold outer regions.* As a comet draws closer to the Sun, there is more coma and a longer tail and as the comet continues its orbit away from the Sun, the warming of the nucleus surface decreases and so does the comet's tail.
8. *Clues in their stories.* Comets are sometimes called dirty snowballs or snowy dirtballs and they have in them debris from the early formation of the Solar System. We aren't sure how much rock and dirt there is compared to the amount of ice, gas and dust. Comets have more unchanged clues about how the solar system bodies formed than we could get from other places. That is why we have comet missions like Deep Impact. Deep Impact will be the first mission to make a deep crater in a comet surface to see what clues are deep inside.
9. *The Sister Comet told secret stories.* Comets that still exist escaped being pulled into the formation of planets but they carry within them the last clues from that period of formation 4.5 billion years ago. It would be difficult to explore the core of a planet the way we plan to explore beneath the surface of a comet to find those remaining clues.
10. *When we see a meteor shower...* Meteor showers are really debris from comets falling into the Earth's atmosphere. Once inside the atmosphere they shoot across the sky and then burn up. We have 40,000 tons of debris from comets falling to Earth every year.
11. *The Sister Comets are waiting for us to search them out again.* We plan space missions to comets so we can find out more about them than we can find out from Earth. We will in a way begin a wonderful relationship with them as we learn more about them.

Tips for telling the story:

Actions:

For light, love and loyalty - use light (open arms wide in a circle), love (cross arms over your heart (loyalty) clasp hands together.

For growing hair, robe and capes - draw arms and hands back behind you to show the lengthening hair, robe and cape.

For the Sun warming the comet's face - use hands to show the glow moving forward from the face and then swept back to the tail behind.

Act out as much of the story in hand actions as possible.

Stress the diminishing relationship with the comets: light, love and loyalty – with fire: light and love – and with electricity: light.

Questions about this activity? Contact Maura.Rountree-Brown@jpl.nasa.gov

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